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DDOC Quarterly status Report No. 14, 1 Jul-30 Sep NEODYMIUM LASER GLASS IMPROVEMENT PROGRAM. ARPA Order

Project Code Number 7300

Contract Number/Nonr 3835(00)

Office of Naval Research Navy Department Washington, D. C.

Dr. (Richard F. Woodcock. Author:

Project Scientist: Dr. William R. Prindle

American Optical Company Research Division Southbridge, Massachusetts ر رتات ال

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During the three month period ending 30 September 1965, the investigation of the athermalization of laser glass has continued. The main areas of investigation were: (1) an independent method of measuring the thermal coefficient of refractive index, (2) determining regression coefficients for the stress-birefringence coefficient, and (3) the measurement of the stress-optical coefficient

THERMAL COEFFICIENT OF REFRACTIVE INDEX

A system has been set up which provides an alternate method of measuring α_n to check on our present method of measurement. The alternate method employs a wave front shearing interferometer which measures the change in optical path thickness of a sample heated in a vacuum furnace by comparison with an identical unheated sample. The system has been assembled and is presently being tested. The light source is a mercury lamp which allows the determination of α_n for various wavelengths in the visible and near infrared.

STRESS-BIREFRINGENCE COEFFICIENT

A regression analysis of the stress-birefringence coefficient, ΔB , as a function of glass composition has been made resulting in a regression coefficient or weighting factor for each of the glass ingredients used. These results indicate some general trends in the effects of composition on stress-birefringence but the accuracy of many of the regression coefficients was too poor to draw any final conclusions at this time. In an effort to improve these values, $\Delta B'$ s were calculated for the regression coefficients and compared with the measured values of ΔB . Classes showing a marked discrepancy between calculated and measured values are being rechecked for possible error in the measured values.

STRESS-OPTICAL COEFFICIENT

Measurement of the stress-optical coefficients, B_{\perp} and B_{\parallel} , have been made on additional glasses. The reproducibility of the measurement of the change in optical path length, $\Delta(nL)$, as a function of applied pressure has been improved. This, however, requires that a slight modification be made in the procedure for measuring ΔL . The above mentioned measurements of B_{\perp} and B_{\parallel} were made on glasses where the elastic constant was known and ΔL could be calculated from the applied pressure. To check these measurements the values of B_{\perp} and B_{\parallel} made in this manner were used to calculate

values of ΔB and the result showed reasonably good agreement with measured values of ΔB ; e.g., for a glass with B_{\parallel} = 7.2 and B_{\perp} = 9.7 the calculated value of ΔB is -2.5 Brewsters compared to the measured ΔB value of -2.4 Brewster.

Some of our present experience indicates that the poor optical quality of our experimental glasses made in small, one pound melts may present a very serious problem in the measurement of the stress-optical coefficient by the present method. Further investigation of this situation is now in progress.